IJCSC International Journal of Computer Science & Communication Vol. 1, No. 1, January-June 2010, pp. 25-28

# Adaptive Analysis of Throughput in Mobile Ad-hoc Network (IEEE-802.11)

**Vikram Bali[1], Rajkumar Singh Rathore[2] & Amit Sirohi[3]**

[1]Department of Computer Science & Engineering, Ideal Institute of Technology, Gzb, India

[2]Department of Computer Science & Engineering, Ideal Institute of Technology, Gzb, India

[3]Department of Computer Science & Engineering, Ideal Institute of Technology, Gzb, India

[1]vikrambali78@gmail.com, [2]rathore.rajkumar@gmail.com & [3]amitsirohiiitk@gmail.com

**ABSTRACT**

The widespread use of mobile and handheld devices is likely to popularize ad hoc networks, which do not re-quire any wired infrastructure for intercommunication. In this paper, we present a Simulation base comparison of mobile ad hoc network with and without mobility. 100x100 meters areas, different data rate (2 & 11 Mbps), and different mobility (1 to 25 m/s) has been chosen. An OPNET simulation is carried out to show the effect of mobility of various nodes on the network.

***Keywords:*** Mobile Ad hoc Network, Static Ad hoc Network, TCP, Routing Protocol, Packet Loss, Routing Failure, Power Constraints, Cross Layer.

## 1. INTRODUCTION

A mobile ad hoc network is a concept that has received attention in scientific research since the 1970s. A clear picture of what exactly is meant by an ad hoc network is difficult to pinpoint. In today's literature the term is used in many different ways. The Internet Engineering Task Force (IETF), the body responsible for guiding the evolution of the Internet, provides the definition as given below [1] and shown in the Fig. 1. A mobile ad hoc network (MANET) is an autonomous system of mobile routers (and associated hosts) connected by wireless links. The routers are free to move randomly and organize themselves arbitrarily; thus, the network's wireless to-pology may change rapidly and unpredictably. Such a network may operate in a stand – alone fashion, or may be connected to the larger Internet. Specifically, in the absence of fixed infrastructure as in MANETs, mobile computing devices (such as handheld devices) may be used to route packets. Mobility of such devices may cause established links to break and consequently established paths between a sender and a receiver to become invalid.

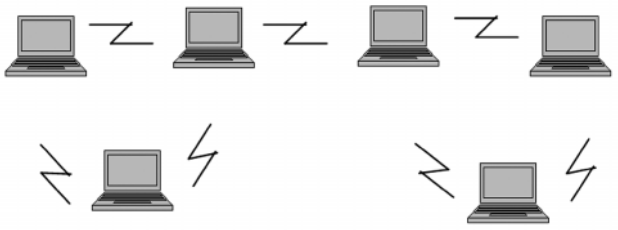

**Fig. 1**

MANETs are useful in many applications be-cause they do not need any infrastructure support such as Base Station Controller of Access point. Collaborative computing and communications in smaller areas (building organizations, conferences, etc.) can be set up using MANETS. Communications in battlefields and disaster recovery areas are further expels of application environments. With the evolution of Multimedia Technology, Quality of Service in MANETs became an area of great interest.

## 2. ISSUES AND DIFFICULLTIES IN MANETS

MANETs differ from the traditional wired Internet infrastructures. The differences introduce difficulties for achieving Quality of Service in such networks. The following list highlights some of the problems:

- *Dynamic Topologies:* Nodes are free to move arbitrarily; thus, the network topology, which is typically multi hop-may change randomly and rapidly at unpredictable times, and may consist of both bidirectional and unidirectional links. The routing protocols for ad-hoc wireless networks have to adapt quickly to frequent and un-predictable topology changes.
- *Bandwidth-constrained, Variable Capacity Links:* Wireless links will continue to have significantly lower capacity than their hardwired counterparts. In addition, the realized throughput of wireless communications after accounting for the effects of multiple access, fading, noise, and interference conditions, etc, is often much less than a radio's maximum transmission rate. One effect of the relatively low to moderate link capacities is that congestion is typically the norm

rather than the exception, i.e. aggregate application demand will likely approach or exceed network capacity frequently. As the mobile network is often simply an extension of the fixed network infrastructure, mobile ad hoc users will demand similar services. These demands will continue to increase as multimedia computing and collaborative networking applications rise.

- *Energy-constrained Operation:* Some or all of the nodes in a MANET may rely on batteries or other exhaustible means for their energy. For these nodes, the most important system design criteria for optimization may be energy conservation.

## 3. ISSUES AND CHALLENGES DUE TO THE MOBILITY OF NODES

Many studies show that TCP performs poorly over wireless links. In this section we will give an overview of some of these problems. [4] The main problem is due to non congestion packet loss. TCP is designed for a wired network where packet loss normally is a result of network congestion. This is necessarily not true for mobile ad hoc networks. Wireless links can have high bit error rates and high probability of packet loss even when there is no congestions. TCP, however, will assume that the network is congested, and the throughput will be degraded. Another problem is related to mobility. When there are disconnections and reconnections in the network, it can easily lead to TCP timeouts. The congestion window will be lowered, and TCP will take a long time to recover. Mobility can also cause arrival of out – of – order packets. The TCP receiver will generate ACK for the highest in – order packet. This will result in duplicate ACKs, and when three duplicate ACKs, have been received, TCP goes into the fast retransmit phase. The another impact of mobility of nodes in Mobile Ad hoc network is Network partitions which also degrades the performance of the Mobile Ad hoc Network. An Ad hoc network can be represented by a simple graph G [5]. Mobile stations are the "vertices". A successful transmission between two stations is an undirected " edge" Network partition happens when G is disconnected. The main reason of this disconnection in MANETs is node Mobility. An example of network partition is illustrated in Fig.2. In this figure dashed lines are the links between nodes. When node D moves away from node C, this results in a partition of the network into two separate components. Clearly, the TCP agent of node A can not receive the TCP-ACK transmitted by node F which results in degradation in the performance of the Mobile Ad hoc network. In wired networks route failures occur very rarely. In MANETs they are frequent events. The main cause of route failures is node mobility. Another factor that can lead to router failures is the link failures due to the contention on the wireless channel. The route re-establishment duration after route failure in Ad hoc net works depends on the underlying routing protocol, mobility pattern of mobile nodes, and traffic characteristics.

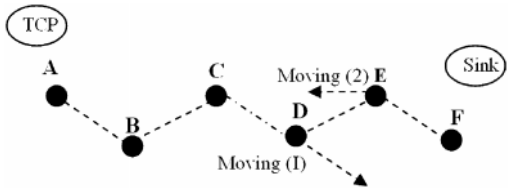


**Fig 2: The TCP Agent of Node A can not Receive the TCP. ACK Transmitted by Node F.**

## 4. SIMULATION

To observe the impact of mobility of nodes in wireless network, we created a wireless node model using OPNET 9.1. We chose a work space area of 100m x 100m to create the office wireless environment. Using OPNET we have simulated two scenarios. In first scenario we have selected 5 mobile nodes with no mobility and in second scenario all the 5 mobile nodes are moving randomly with different speeds. Attributes except mobility for both the scenarios are same and tabulated as follows.

The packet size distribution is exponential with a mean of 1024bytes. The inter arrival time is exp (.1) for all the nodes. All the nodes are using Frequency Hopping Spread Spectrum at the physical layer. Data rate of each node is as follows:

Simulation parameters common for both scenarios:

Wireless LAN MAC Address: Auto Assign

Inter –arrival Time (seconds) : Exponential (0.002)

RTS Threshold (byte):256

Packet Reception: Power Threshold : 5.33E-14

Short Retry Limit:9

Long Retry Limit:6

Channel Bandwidth: 5,000KHz

Buffer Size: 128000 bits

Max Receive Lifetime : 1 Sec

Large Packet Processing : Drop

The simulations were carried for 600 simulation seconds (i.e. 10 minutes) and repeated many times in order to ascertain validity. In order to study the impact of mobility in the network global parameters are plotted. The global parameters were chosen as end to end delay and throughput and are plotted for both the scenarios.

**Scenario 1**

| *Node* | *Date rate* | *Mobility* |
|---|---|---|
| Node 1 | 2 Mbps | 1m/s |
| Node 2 | 3 Mbps | 2m/s |
| Node 3 | 4 Mbps | 5m/s |
| Node 4 | 5.5 Mbps | 10m/s |

**Scenario 2**

| *Node* | *Date rate* | *Mobility* |
|---|---|---|
| Node 1 | 3 Mbps | 11m/s |
| Node 2 | 4 Mbps | 15m/s |
| Node 3 | 5.5 Mbps | 20m/s |
| Node 4 | 11 Mbps | 25m/s |

## 5. SIMULATION RESULTS

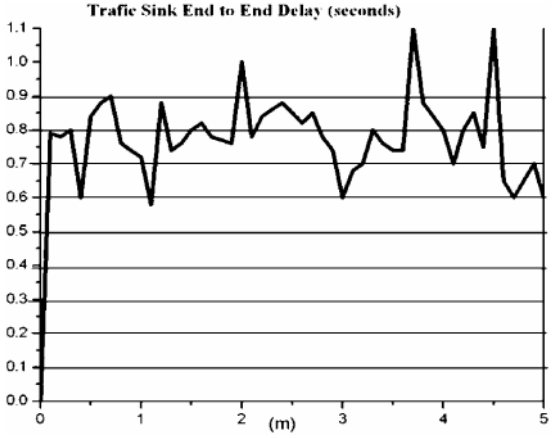


**Fig. 1 (a): End to End Delay (Mobile Nodes)**

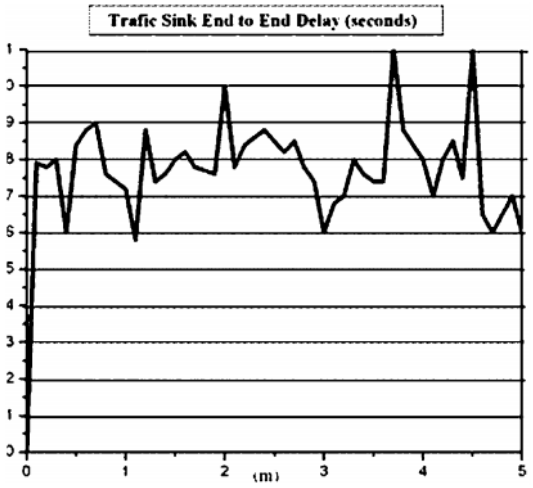


**Fig. 1 (b): End to End Delay (Fixed Nodes)**

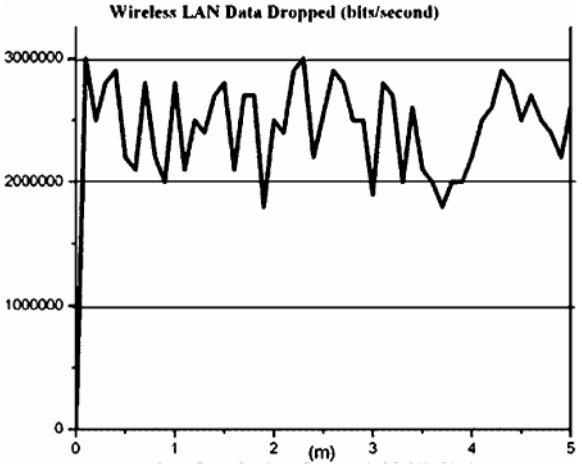


**Fig. 2 (a): Data Packets Dropped (Mobile Nodes)**

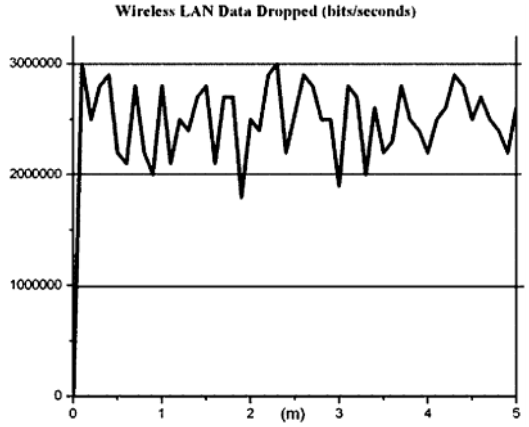


**Fig. 2 (b): Data Packets Dropped (Fixed Nodes)**

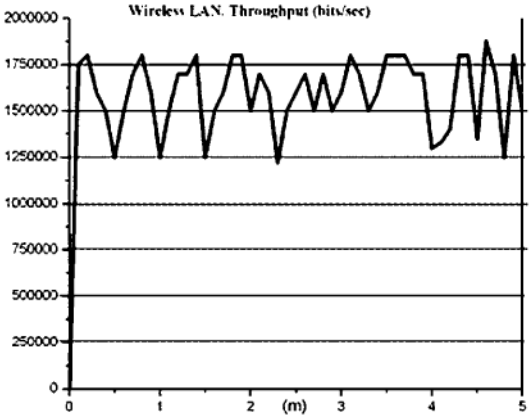


**Fig. 3 (a): Throughput (Static MANET)**

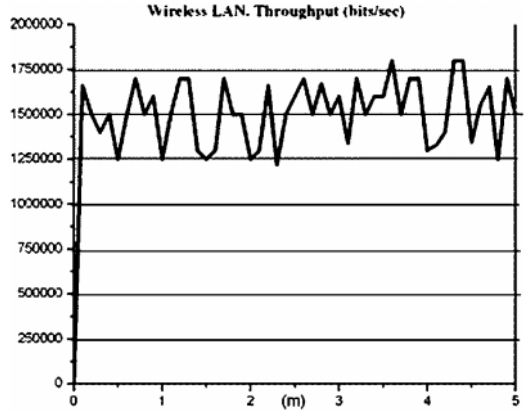


**Fig. 3 (b): Throughput (Mobile Ad hoc Network)**

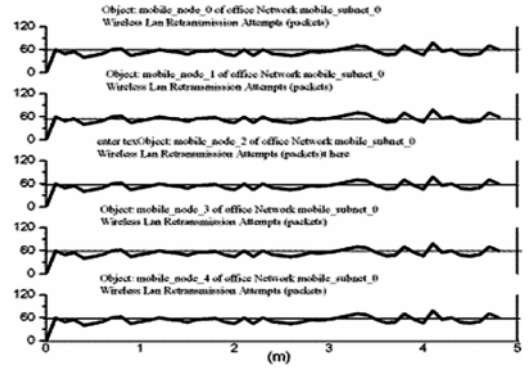


**Fig. 4 (a): Retransmission Attempts of the Mobile Nodes**

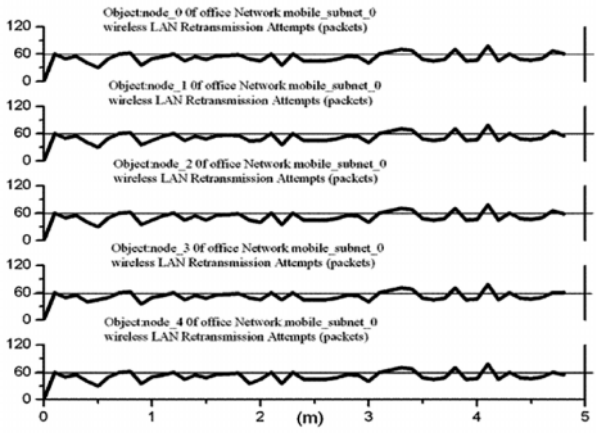


**Fig. 4 (b): Retransmission Attempts of the Fixed Nodes**

## 6. CONCLUSION

We have analyzed the results of simulations with and without mobility of the nodes. The results of our simulation show that mobility of nodes has big impact on the network. The mobility of node results in frequent network partitions and route failure which is primary reason of throughput degradation in Mobile Ad hoc Network. Frequent disconnection and reconnection is responsible for poor performance of TCP in Mobile Ad hoc network.

## REFERENCES

[1] Brooke Shrader A Proposed Definition of 'Ad hoc Network', 2002.

[2] Zeinalipour – Yazti Demetrious: A Glance at Quality of Services in Mobile Ad – Hoc Network.

[3] Kui Wu and Janelle Harms: QoS Support in Mobile Ad Hoc Network.

[4] Andrea Hafslund, Lars Landmark, Paal Engelstad and Frank Y. Li: Testing and Analyzing TCP Performance in Wireless- Wired Mobile Adhoc Test Bed.

[5] Ahmad Al Hannbali, Eitan Altman, Philippe Nain: A Survey of TCP over Ad Hoc Networks.

[6] M. Young, The Techincal Writers Hand –book. Mill Valley, CA: University Science, 1989.

[7] Holland G, and Vaidya, N. (2002) :Analysis of TCP Performance over Mobile Ad Hoc Networks" Wireless Networks March 2002, **8**. Issue 2/3 Kluwer Academic Publishers Hingham, MA, USA p. 275 – 288.